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Original Research Article

Effect of hippo therapy on balance and function in children with spastic diplegia

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Abstract

Introduction: Hippo therapy is a form of physical, occupational and speech therapy in which a therapist uses the characteristic movements of a horse. The horse's pelvis has a similar three-dimensional movement to the human's pelvis at the walk. This movement provides physical and sensory input which is variable, rhythmic and repetitive which leads to improvement in spasticity and balance.

Objective: The study aimed to find the effect of hippo therapy on balance and function in children with spastic diplegia.

Material and methods: A quasi-experimental study was conducted at College of Physiotherapy, Ahmadabad. Sixteen children (8 in control group (A) and 8 in experimental group (B) with spastic cerebral palsy, aged 3 to 10 years with GMFCS level 1, 2, body weight less than 35 kg were included. Children with history of botulism toxin injection within 6 months, selective dorsal rhizotomy or orthopedic surgery within 1 year, moderate to severe intellectual disability, uncontrolled seizures, and poor visual or hearing acuity were excluded. Both groups were given neuro developmental technique (NDT), group B was given additional hippo therapy (riding on horse with minimal support as required) for 15 minutes twice a week. Outcome measures were Pediatric balance scale (PBS), GMFM 66, 88, Modified Ashworth scale. Level of significance was kept at 5%.

Result: Within group, analysis did not show significant difference in GMFM scores in group A ($W = 1.84$, $p = 0.066$), but showed significant difference in PBS score ($W = 2.214$, $p = 0.027$). Within group analysis for group B showed significant difference in both GMFM score ($W = 2.207$, $p = 0.027$) and PBS score ($W = 2.214$, $p = 0.027$). Between group analysis for GMFM score showed significant difference ($U = 0.500$, $p = 0.005$). But there was no significant difference in between group analysis for PBS score ($U = 12.00$, $p = 0.321$).

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Conclusion: Hippo therapy and NDT both have similar effect for improving balance in spastic diplegic children. But Hippo therapy has an additional effect for improving gross motor function.

Key words

Spastic diplegia, Hippo therapy, GMFM 66 and 88, Pediatric balance scale, Balance.

Introduction

Cerebral palsy describes a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain [1]. Spastic cerebral palsy is most common. Spasticity is velocity dependent increase in muscle tone. It affects the hip adductors, hamstrings and calf muscles. Spasticity in calf muscles pulls the toes down toward the ground. In a standing position, this causes the knees to bend excessively backwards and the hips to bend forward. The body centre of gravity is altered in this position; affecting balance [2]. Children with cerebral palsy use extensor muscles excessively in order to maintain their sitting posture, mobilize or recruit muscles abnormally, and use antagonistic muscles excessively [3, 4].

Hippo therapy is a treatment strategy. It uses equine movement as part of an integrated intervention program for achieving functional outcomes [5]. It is a form of physical, occupational and speech therapy in which a therapist uses the characteristic movements of a horse [1]. This movement provides physical and sensory input which is variable, rhythmic and repetitive which leads to improvement in spasticity and balance.

A systematic review found insufficient evidence that long-term equine (horse) assisted activities or therapy provide a significant benefit to children with spastic cerebral palsy [6]. Primary aim of the study was to find the effect of hippo therapy on balance in children with spastic diplegia. Secondary aim of the study was to find the effect of Hippo therapy on gross motor function and spasticity.

Material and methods

A quasi-experimental study was conducted at the S.B.B College of physiotherapy, V.S Hospital, Ahmedabad for 4 weeks. Using purposive sampling 16 children with spastic cerebral palsy which aged 3 to 10 years both male and female were included in the study. The other inclusion criteria were gross motor function classification score (GMFCS) between1 and 2 and with body weight less than 35 kg. Children with selective dorsal rhizotomy, orthopaedic surgery within last 1 year, with history of botulism toxin injection within 6 months, moderate to severe intellectual disability and poor visual or hearing acuity were excluded from the study.

16 children with spastic diplegia were randomly divided in to two groups, group A (control group) receiving neuro developmental therapy (NDT) regularly and group B (experimental group) receiving neuro developmental technique regularly along with hippo therapy for 15 minutes twice a week. Written consent was taken from all the parents.

The basic principle of NDT is the inhibitory control of abnormal movement patterns and simultaneous facilitation of automatic postural reactions (righting and equilibrium reactions). With the therapist's hands combined with different techniques of stimulation to reduce the dysfunctional abnormal postural tone to facilitate and transmit to the child a variety of

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sensory-motor experiences in functional and goal directed activities [13] were used.

For hippo therapy child was made to sit on a horse with a horse rider sitting behind giving a minimal support at trunk and the horse was made to trot on the plain ground at a tolerable speed for 15 minutes. **(Photo – 1 and Photo – 2)**

Photo – 1: Hippo therapy.

Pre and post intervention Pediatric Balance Scale (PBS) scores, Gross Motor Function Measure (GMFM) scores, and Modified Ashworth scale scores (MAS) for adductors, hamstring and plantar flexors were documented.

Statistical analysis

Level of significance was kept at 5%. Within group, analysis was done using Wilcoxon test and between groups, analysis was done using Mann Whitney U test.

Photo – 2: Hippo therapy.

Results

Sixteen children with spastic diplegia with mean age of 6±1.18 years and GMFCS level 1and 2 were divided into two groups, eight in control group and eight in experimental group. There were two drop outs in experimental group as they went for Botox treatment and two drop out in control group due to ill health. Study was completed with 12 children with six children in each group.

Differences within group analysis for pediatric balance scale sore ($p \leq 0.05$) and Gross motor function measure scores ($p \leq 0.05$) were as per **Table – 1** and **Table - 2**. Differences in within group analysis for modified Ashworth scale

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scores for adductor, hamstring and plantar flexor group of muscles in experimental group were as per **Table – 3**, **Table – 4** and **Table - 5**. Difference between groups for modified Ashworth scale scores for adductors and gross motor function measure scores ($p \leq 0.05$) and no significant difference in paediatric balance scale scores and modified scale scores for hamstring and plantar flexor group of muscles ($p \geq 0.05$) were as per **Table – 6**.

Discussion

In the present study, at the end of intervention there was significant difference found within group and between group analysis for GMFM scores and modified Ashworth scale score for adductor muscle group. Whereas there was significant difference within the group analysis for PBS score and modified Ashworth scale score for hamstring and plantar flexor group but between group analyses showed no significant difference. Hence the present study showed that hippo therapy has additional effect on gross motor function and tone of adductor muscle but no such effect on balance and hamstring and plantar flexor muscle group.

Children with cerebral palsy in this study showed significant improvement in MAS, PBS, GMFM scores with NDT. Tsorlakis in his study examined the effect of neurodevelopmental treatment (NDT) and differences in its intensity on gross motor function of children with cerebral palsy (CP). Results supported the effectiveness of NDT and underline the need for intensive application of the treatment [7]. GMFM scores have improved in this study. Gibbon, et al. reported that children (N=5) with cerebral palsy showed a significant decrease in energy expenditure during walking following hippo therapy. Significant increase in scores on dimension E of the GMFM (Walking, Running, and Jumping) was seen after hippo therapy for 30 minutes twice weekly for 8 weeks [8]. Casady, et al. in their study concluded that hippo therapy has a positive effect on the functional motor performance of children with cerebral palsy. Hippo therapy appears to be a viable treatment strategy for therapists with experience and training in this form of treatment and a means of improving functional outcomes in children with cerebral palsy [9]. Five therapeutic riding (TR) studies and nine observational studies of hippotherapy (HPOT) were included in a meta-analysis that indicated that short-term HPOT (total riding time 8–10 min) significantly reduced asymmetrical activity of the hip adductor muscles. HPOT could improve postural control in children with spastic CP, GMFCS level < 5. However, the evidence did not show a statistically significant effect on GMFM after long-term HPOT or TR (total riding time, 8–22 h) in children with spastic CP [6].

The horse provides a dynamic base of support. It is an excellent tool for improving trunk strength, control, and balance and building overall postural strength and endurance [10]. It also addresses weight bearing; and motor planning [10]. The walking horse transmits some 110 three-dimensional movement impulses per minute onto the person on its back: forward-backward, side-to-side, up-and-down, and rotational movements [11]. There was no difference in PBS scores between the groups. PBS measures the standing balance but doesn't measure component of balance in sitting while the subjects in group B showed improvement in B component of GMFM scales which tests trunk control in sitting. The proper posture during horseback riding is to maintain 90° hip joint and 90° knee joint, and such posture induces decrease in the muscle tone and spasticity of the riders. The posture of children during horseback riding naturally alleviates the tension and enables functional movement. While taking therapeutic riding, children with cerebral palsy

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recovers an appropriate posture, and maintaining the appropriate posture plays an important role of reducing the spasticity [12, 13]. Standing balance improvement may require longer duration of intervention.

Limitations for the present study were cost for hiring the horse and due to this reason the study was not performed for a longer time and long term follow up was not taken. Further study could be carried out which includes long term intervention and long term follow up.

Conclusion

Short duration Hippo therapy and NDT leads to more improvement in gross motor function measures and tone of adductor muscle group than NDT alone and leads to same improvement in balance and tone of hamstring and plantar flexor group of muscle as NDT alone.

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Table - 1: Comparison of mean pediatric balance scale scores within group.

Group	Mean±SD (pre)	Mean±SD (post)	Z value	p value
Control group	1.76±3.78	1.78±3.74	1.84	0.06
Experimental group	1.69±3.71	1.75±3.81	2.207	0.027

Table - 2: Comparison of mean Gross motor function measure scores within group.

Group	Mean±SD (pre)	Mean±SD (post)	Z value	p value
Control group	31±1.26	33.16±1.29	2.214	0.027
Experimental group	27±1.14	30±1.22	2.214	0.027

Table - 3: Comparison of median MAS for adductor muscles within group.

Group	Median (pre)	Median (post)	W value	p value
Control (left side)	2.5	2	1.73	0.081
Experimental (left side)	3	1.5	2.07	0.038
Control (right side)	3.5	2	1.89	0.059
Experimental (right side)	3	1	2.232	0.026

Table - 4: Comparison of median MAS for hamstring muscles within group.

Group	Median (pre)	Median (post)	W value	p value
Control (left side)	3.5	2.5	1.89	0.059
Experimental (left side)	2.5	1	2.271	0.023
Control (right side)	3.5	2	1.84	0.06
Experimental (right side)	3	1	2.26	0.024

Table - 5: Comparison of median MAS for plantar flexor muscles within group.

Group	Median (pre)	Median (post)	W value	p value
Control (left side)	2	1	1.189	0.059
Experimental (left side)	2.5	1	2.070	0.038
Control (right side)	2	1	1.89	0.059
Experimental (right side)	3	1	2.041	0.041

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Table - 6: Comparison of mean/median of pediatric balance scale scores, Modified Ashworth scale scores for adductors, hamstring, plantar flexors and gross motor function measure scores between groups.

Outcome measures	Median/mean of control group	Median/mean of experimental group	U value	p value
PBS	2.16±1.16	3.16±1.83	12	0.321
MAS of adductor (right)	1	2	6.5	0.051
MAS of adductor (left)	0.5	1.5	7.5	0.042
MAS of hamstring (right)	1	1	16	0.72
MAS of hamstring (left)	1	1	11	0.206
MAS of plantar flexor (right)	1	1.5	11	0.238
MAS of plantar flexor (left)	1	1	13.50	0.434
GMFM	1.66±1.62	6.33±1.63	0.500	0.005

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